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INTEROFFICE CORRESPONDENCE

Richmond, Virginia

To: Distribution **Date**: October 17, 1997

From: J. M. Garman

Subject: **Massachusetts Compliance: Determination of pH of Mainstream Smoke in an Aqueous Solution (DRAFT)**

The Product Testing Laboratory (PTL) has been charged with determining the pH of mainstream smoke in an aqueous solution in compliance with the Massachusetts Regulations dated August 19, 1997. This memo contains PTL's results in preparation for the implementation of this analysis. Included are a comparison of pH results for 44 mm Cambridge filter pads from different manufacturers, pH results obtained for the Whatman Cambridge filter pad, pH results for the degassed water, pH results obtained for IM#15, a pH reproducibility study using IM#16, and results obtained for Kentucky Reference cigarettes.

pH Results

Four replicate pH analyses were performed on each type of 44 mm Cambridge filter pad currently within PTL. The pH was determined on one pad inserted in 100 mL of degassed water recorded after 5 minutes. The results are tabulated below:

TABLE I: pH Comparison of Cambridge Filter Pads

	Whatman	Gelman	Performance Systematix
Replicate 1	8.324	8.148	7.734
Replicate 2	8.267	8.184	7.264
Replicate 3	8.600	8.207	7.473
Replicate 4	8.127	8.290	7.300
Average	**8.330**	**8.207**	**7.443**
Standard Deviation	**0.20**	**0.06**	**0.21**

The Whatman filter pads will be used for all pH determinations since they are certified by the manufacturer to meet ISO 3308 specifications. Utilizing the same pH procedure to generate the comparison data above, the following pH results have been obtained for the Whatman pads during the 10/6/97 to 10/17/97 time period:

PM3000376456

Source: https://www.industrydocuments.ucsf.edu/docs/jxwl0001

Table II: pH Results for Whatman Cambridge Filter Pads

Date of Analysis	pH Result
10/6/97	8.324
10/6/97	8.267
10/6/97	8.600
10/6/97	8.127
10/8/97	8.306

Date of Analysis	pH Result
10/9/97	8.289
10/10/97	7.962
10/15/97	7.695
10/16/97	8.046
10/17/97	8.119
Overall Average	**8.174**
Standard Deviation	**0.24**
Determinations	**10**

The pH results obtained for the bottles of degassed water are listed below:

Table III: pH Results for Degassed Water

Bottle Number	Date Degassed	Date of Analysis	pH Result
1	10/5/97	10/6/97	6.054
1*	10/5/97	10/8/97	6.052*
2	10/7/97	10/8/97	6.647
3	10/15/97	10/17/97	5.925
4	10/16/97	10/17/97	6.254
		Average	**6.220**
		Standard Deviation	**0.32**

* pH result not included in average

The PRD and Battelle procedures include a smoking blank. Only one result was obtained using FTC smoking procedure and three results were obtained using the Massachusetts protocol.

Table IV: pH of the Smoking Blank

Date of Analysis	pH Result
10/6/97 (FTC)	7.062
10/15/97 (MA)	6.977
10/16/97 (MA)	6.969
10/17/97 (MA)	7.053

Source: https://www.industrydocuments.ucsf.edu/docs/jxwl0001

Following are the results for the pH determination of IM#15 following FTC protocol, (equilibration and puff parameters).

Table V: FTC pH Results for IM#15

Date of Analysis	pH Result
10/6/97	5.192
10/6/97	5.141
10/6/97	5.172
10/6/97	5.178
Average	**5.171**
Standard Deviation	**0.022**

A reproducibility study was conducted over a three day period in which ten determinations on IM#16 were performed on each day. Within each subgroup of ten, the cigarette holder impinger orifice tube was rinsed with aliquots of the water after smoking for five of the replicates while no rinsing was performed on the other five replicates. Since IM#16 will be used as the cigarette monitor for all subsequent pH determinations, IM#16 was used in this study. The smoking was performed following the Massachusetts protocol.

Table VI: Results of IM#16 pH Reproducibility Study

Rinsing of Impinger Tube	pH Result
10/8/97	5.351
Standard Dev.	0.016
Replicates	5
10/9/97	5.3248
Standard Dev.	0.033
Replicates	5
10/10/97	5.350
Standard Dev.	0.027
Replicates	5
Average	**5.359**
Standard Deviation	**0.021**
Replicates	**15**

No Rinsing of Impinger Tubes	pH Result
10/8/97	5.350
Standard Dev.	0.019
Replicates	5
10/9/97	5.327
Standard Dev.	0.021
Replicates	5
10/10/97	5.344
Standard Dev.	0.036
Replicates	5
Average	**5.340**
Standard Deviation	**0.027**
Replicates	**15**

Overall Average	**5.350**
Standard Deviation	**0.025**
Replicates	**30**

Source: https://www.industrydocuments.ucsf.edu/docs/jxwl0001

The statistical evaluation of the results is included in the attached memo, C. Boswell to J. Garman, "pH on Aqueous Solution Analysis," October 16, 1997. The results did show a slight,(0.020), but statistically significant, difference between rinsed and non-rinsed results. The obtained confidence interval for ten replicates was found to be ±0.019 while five replicates produced a ±0.027 confidence interval.

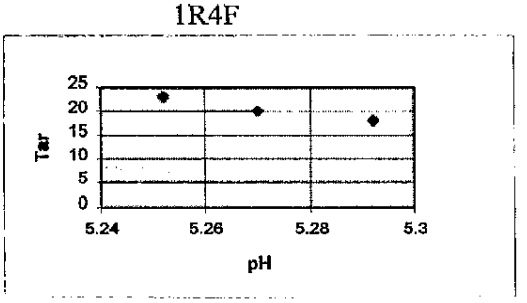
The 2R1F, 1R3F, 1R4F, and 1R5F Kentucky Reference Cigarettes were analyzed for pH utilizing five replicates and smoked per the Massachusetts protocol. All four versions were analyzed as is while the ventilated 1R4F and 1R5F versions were also analyzed with the tipping paper half taped and fully taped. The results are listed below:

Table VII: pH results for Kentucky Reference Cigarettes

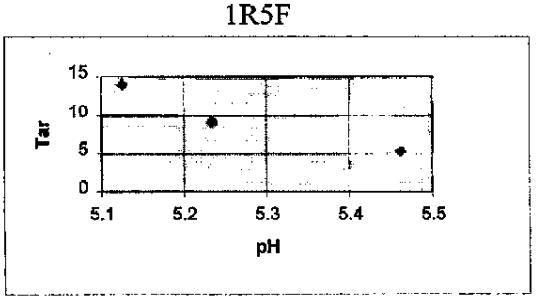
Sample	pH (As Is)	pH (Half Taped)	pH (Fully Taped)
2R1F	5.281	-	-
Stand. Dev.	0.027		
Replicates	5		
1R3F	5.253	-	-
Stand. Dev.	0.028		
Replicates	5		
1R4F	5.292	5.270	5.252
Stand. Dev.	0.079	0.031	0.044
Replicates	5	5	5
1R5F	5.461	5.235	5.127
Stand. Dev.	0.052	0.039	0.040
Replicates	5	5	5

Following, is a graphical representation of what appears to be a correlation between the tar and pH for the 1R4F and 1R5F.

1R4F



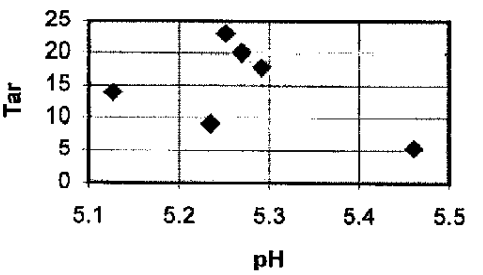
1R5F



Source: https://www.industrydocuments.ucsf.edu/docs/jxwl0001

This correlation is only valid for ventilation differences for a given brand and not a global tar to pH correlation.

1R4F & 1R5F



Attachment

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